



II. REPORTS ON RESEARCH

1 DEPARTMENT OF NUCLEAR REACTIONS

Head of Department: Dr Krzysztof Rusek
phone: (22) 621-38-29
e-mail: rusek@fuw.edu.pl

Overview

The last year of the twentieth-century was productive for our Department. Although the name of the Department suggests that we are all involved in investigations of nuclear reactions, in fact our activities are spread over three major domains: nuclear, atomic and material physics. Some of the projects we were involved in the last year have been realized using national facilities and accelerators, like the Van de Graaff accelerator of our Department at 69 Hoza Street, Warsaw Cyclotron U-200P of Warsaw University, and compact C30 cyclotron of our Institute at Świerk. Other projects were done abroad, using facilities of the Gesellschaft für Schwerionenforschung in Darmstadt, Institute de Physique Nucleaire at Orsay, and Universitaet Erlangen – Nürnberg in Erlangen. We carried out our work in close collaborations with physicists from many laboratories, Polish and foreign.

- Low energy nuclear reactions

In collaboration with scientists from Ukraine experiments, using heavy ion beam provided by the Warsaw Cyclotron, was started. The aim of the experiments is to study nuclear reactions leading to the exotic light nuclei in exit channels and energy dependence of the nucleus - nucleus interaction.

Efforts were made to develop a multistep direct model of nuclear reactions. In the model contributions due to the low energy collective excitations were taken into account. Good agreement with the experimental data was achieved.

- Multifragmentation of relativistic heavy ions

ALADIN Collaboration studied multifragmentation reactions induced by relativistic heavy ions. The main activities of our scientists concentrated on an upgrade of the detecting system in order to replace photo multipliers with large area avalanche photodiodes in the central section of the TOF-wall. Some tests of the photodiodes manufactured by Advanced Photonix Inc. were performed using standard β - and γ -sources.

- Structure of a nucleon

Decay properties of the Roper resonance were studied. A signature of coherent pion production in the excitation of α – particles scattered from protons has been found. It offers a means to separate the excitation of the proton from that of the α – particle in the measured decay.

- Atomic physics

Ionisation probabilities in collision of heavy ions from several heavy atoms were measured. A novel method of analysis of multiple ionisation effects was developed.

- Materials research

Crystallochemical studies of U_3O_7 showed that this uranium-oxygen system forms polytypes that differ by the stacking manner of identical cluster layers. Seven basic sequences of these layers were determined.

Samples of a human brain were investigated by means of PIXE method. Accumulation of variety of elements in brain tissue was studied. It was found that the concentration of zinc dramatically increases with age. This can be related to the increasing with age probability of Parkinson's disease.

The following reports present results and major successes that we achieved in the year 2000.